

Cereal Vending Machine

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Abstract- “Cereal Vending Machine” designed using Load cell sensor to detect the weight of dispensed item through the container. ADC module is used as mediator between controller and load cell sensor. The cereal vending machine is proposed to reduce the amount of food waste while grain spills out of the storage tank during manual processing “CVM” cereal vending machine, Customer enters a number as weight of required amount of grains such as wheat, rice etc. the container dispenses the entered amount of cereal in basket. This process takes minimum time as compared to manual weighing of cereals and also no worker is needed.

Keywords- Arduino Uno board, Load cell sensor, LCD Display, 4*4 Keypad, Servo Motor, Vending Machine.

I. INTRODUCTION

Vending Machine: The actual meaning of vending machine may refer to an automatic machine or container which is designed to release a specific amount of something from it in an easy and convenient way.

This project is related to the smart dispensing process, can be used in large grocery shops, shopping malls etc. Moreover, this project can be helpful for the Grocery distribution centers located in every city by Our Government for the families below poverty line. This project will help to reduce the man power required in cereal distribution process. It also saves the time of customers since the automation takes less time than manual process.

This project “CEREAL VENDING MACHINE” is a very innovative system which will help to make the cereal distribution, cereal purchasing even smarter, easier and more convenient. This system has a large container containing cereal e.g. wheat, rice, etc. This system dispenses the amount of article entered by the user in **grams/ kilograms** on keypad (input to the controller) . For this system we have used **Load cell sensor** placed below the cereal container to weigh the dispensed article from container. The weight of dispensed article is continuously being compared with the entered amount. Once both matched, controller terminates the dispensing process.

The LCD screen is used to Display the entered input as well as weighed amount of article by load cell sensors.

- 1) Read already published work in the same field.
- 2) Gogglng on the topic of your research work.

II. OBJECTIVE

The purpose of this project is in cereal distribution centers most of the grains are wasted due to careless handling. The careless monitoring systems and time consuming process is one of the primary problems of the present era.

Arduino is used as a smart controlling unit to monitor all the distribution process in efficient an easy way.

III. BLOCK DIAGRAM

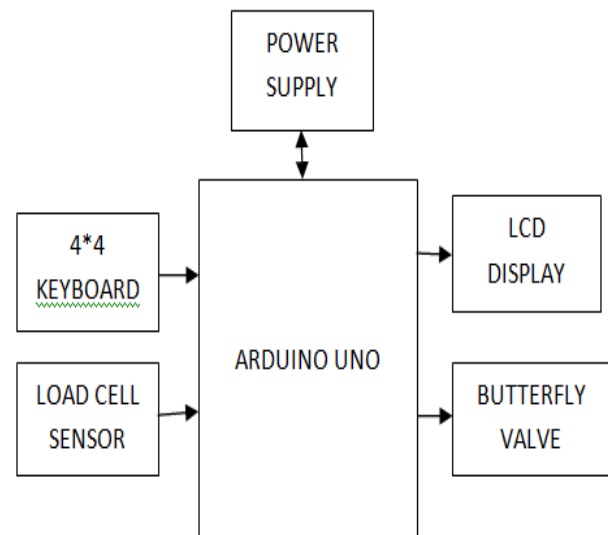


Figure 1. Block diagram of CEREAL VENDING MACHINE

IV. WORKING PRINCIPLE

In the “CEREAL VENDING MACHINE” when the user first enters the amount of article using keypad (i/p) to the controller). In this system load cell sensor is used. Load cell sensor is placed below the cereal container to load the dispenses article from container. When user enter the amount

of article at that time servo motor gets open and start to dispenses article from container.

The weight of dispensed article is continuously being compared with the entered amount. Ones both matched, controller terminates the servo motor.

And in that ADC is used for sending the analog data from load cell sensor to Arduino controller.

And in the LCD screen it is used to display the entered i/p as well as weighted amount of article by using load cell sensor. When user enters the required amount in Kg, Butterfly valves rotates and dispenses cereals through a nozzle into Basket kept on load cell sensor.

Once the level is reached the sensor sends terminating command to controlling unit and Butterfly valve gets closed immediately.

V. CIRCUIT DIAGRAM OF MACHINE

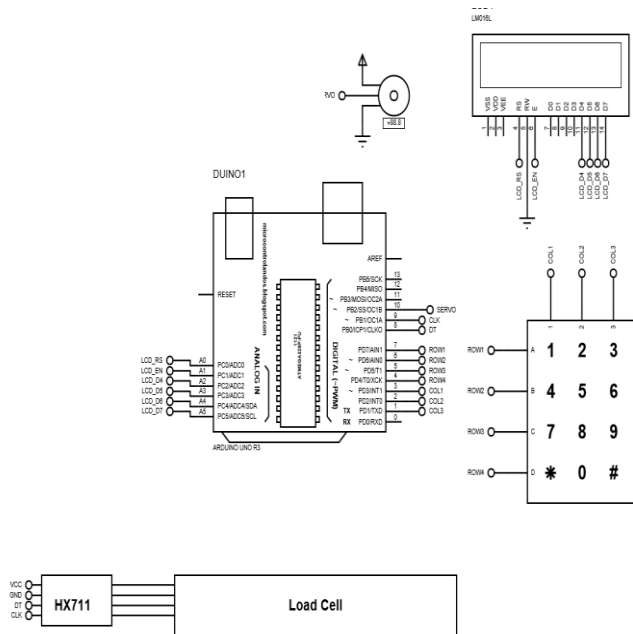


Figure 2. Circuit Diagram

VI. HARDWARE SPECIFICATION

A) Power Supply (SMPS):-



Figure 3. SMPS

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy

B) Arduino UNO:



Figure 4. Arduino UNO

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

Specifications:-

- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts

- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

C) ADC DEVICE (0804):-

Analog-to-digital converters are among the most widely used devices for data acquisition. Digital Computers use binary (discrete) values, but in the physical world everything is analog (continuous). Temperature, pressure, humidity, and velocity are a few examples of physical quantities that we deal with every day. Physical quantity is converted to electrical (voltage, current) signals using a device called a transducer. Transducers are also referred to as sensors. Therefore, we need an analog-to-digital converter to translate the analog signals to digital numbers so that the micro controller can read them.

D) LCD : LIQUID CRYSTAL DISPLAY(16X 2):-



Figure 5. LCD Display

LCD(Liquid Crystal Display) screen is an electronic display module and find a wide range of application. A 16X2 LCD display is very basic module and very commonly used in various devices and circuits. A 16X2 means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5X7 pixel matrix. This LCD has two registers, namely command and Data.

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The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

E) MG995 High Speed Servo Actuator

The unit comes complete with color coded 30cm wire leads with a 3 X 1 pin 0.1" Pitch type female header connector that matches most receivers, including Futaba, JR, GWS, Cirrus, Blue Bird, Blue Arrow, Corona, Berg, Spektrum and Hitec.

This high-speed servo actuator is not code dependant; You can use any servo code, hardware or library to control them. The MG995 Actuator includes arms and hardware to get started.



Figure 6. Servo Motor

Specifications

- Weight: 55 g
- Dimension: 40.7 x 19.7 x 42.9 mm approx.
- Stall torque: 8.5 kgf•cm (4.8 V), 10 kgf•cm (6 V)
- Operating speed: 0.2 s/60° (4.8 V), 0.16 s/60° (6 V)
- Operating voltage: 4.8 V to 7.2 V
- Dead band width: 5 μ s
- Stable and shock proof double ball bearing design
- Temperature range: 0 °C – 55 °C

F) 4x4 Matrix Membrane Keypad (#27899)

This 16-button keypad provides a useful human interface component for microcontroller projects.

Convenient adhesive backing provides a simple way to mount the keypad in a variety of applications.



Figure 7. 4X4 keypad

Key Specifications

- Maximum Rating: 24 VDC, 30 mA
- Interface: 8-pin access to 4x4 matrix
- Operating temperature: 32 to 122 °F(0 to 50°C)
- Dimensions: Keypad, 2.7 x 3.0 in (6.9 x 7.6 cm)
Cable: 0.78 x 3.5 in (2.0 x 8.8 cm)

G) RESISTORS: -

A Resistor is a heat-dissipating element and in the electronic circuits it is mostly used for either controlling the current in the circuit or developing a voltage drop across it, which could be utilized for many applications. There are various types of resistors, which can be classified according to a number of factors depending upon:

- Material used for fabrication
- Wattage and physical size
- Intended application
- Ambient temperature rating
- Cost

H) CAPACITORS:-



Figure 8. Electrolytic Capacitor

An **electrolytic capacitor** (abbreviated **e-cap**) is a polarized capacitor whose anode or positive plate is made of a metal that forms an insulating oxide layer through anodization. This oxide layer acts as the dielectric of the capacitor. A solid,

liquid, or gel electrolyte covers the surface of this oxide layer, serving as the (cathode) or negative plate of the capacitor. Due to their very thin dielectric oxide layer and enlarged anode surface, electrolytic capacitors have a much higher capacitance-voltage (CV) product per unit volume than ceramic capacitors or film capacitors, and so can have large capacitance values. There are three families of electrolytic capacitor: aluminum electrolytic capacitors, tantalum electrolytic capacitors, and niobium electrolytic capacitors.

The fundamental relation for the capacitance between two flat plates separated by a dielectric material is given by:-

I) LIGHT EMITTING DIODES:



Figure 9. Light emitting Diode

It is a semiconductor diode having radiative recombination. It requires a definite amount of energy to generate an electron-hole pair.

The same energy is released when an electron recombines with a hole. This released energy may result in the emission of photon and such a recombination. The amount of energy released when the electron reverts from the conduction band to the valence band appears in the form of radiation. Alternatively the released energy may result in a series of phonons causing lattice vibration. Diodes having radiative recombination are termed as Light Emitting Diode, abbreviated as LEDs.

J) TRANSISTOR: -

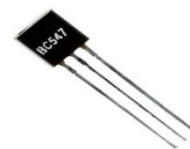


Figure 10. Transistor

A transistor consists of two junctions formed by sandwiching either p-type or n-type semiconductor between a pair of opposite types. Accordingly, there are two types of transistors namely: -

K) Buzzer:-



Figure 11. Buzzer

A **buzzer** or **beeper** is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (*piezo* for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

L) LM 7805:-

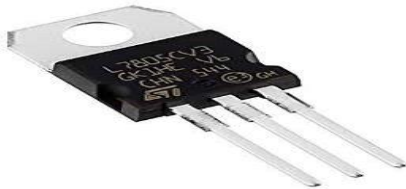


Figure 12. Voltage regulator

1. Input
2. GND
3. Output

The LM78XX series of three terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

M) Load cell sensor:

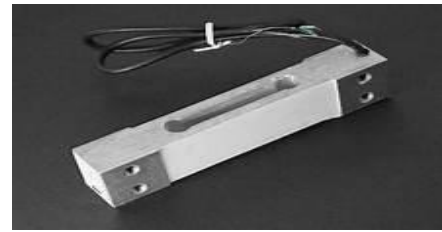


Figure 13. Load Cell Sensor

When the minimum weighing value (1 digit) is small compared to the rated capacity, the load cell output per digit should be above the input sensitivity of the indicator.

Example of a value-weighing scale

Force applied onto the weighing pan is converted into electrical signals by the load cell and output to the indicator.

Rated capacity: 6 kg

Rated output: 1 mV/V

Recommended excitation voltage: 10 V

When the rated output is 1 mV/V and the excitation voltage is 10 V, the load cell will output 10 mV to the indicator. This is the output voltage when the rated capacity of 6 kg is loaded.

(Load) 6 kg → 10 mV (Output Voltage)

If we want to weigh an object of 6,000 g using this load cell and display the result from 1 g (1 g is called the minimum weighing value), how many mV will be output for a load of 1 g? Since the load cell will output 10 mV for a load of 6 kg.

VII. CONCLUSION

With the help of this system we can give accurate measures of food grains and requirement of less man force. Using this system machine which dispenses items such as rice, Wheat etc. to customer automatically, after a customer enter a amount of cereal. Thus it is portable we can setup the system anywhere we need.

VIII. AKNOWLEDGEMENT

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